

## 1/20

## SEQUENCE LISTING

TOSTA E SILVA, OSWALDO DA VAN THIELEN, NOCHA CHEN, ROUYING ISHITANI, MANABU

<120> PHOSPHATASE STRESS-RELATED PROTEINS AND METHODS OF USE IN PLANTS

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<140> 09/828,302

<141> 2001-04-06

<150> 60/196,001

<151> 2000-04-07

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Leu Ser Glu Glu Asp Lys Ser Ser Glu Pro Ser Leu Glu Tyr Trp Phe
420 425 430

Lys Cys Val Asp Leu Asp Cys Asp Gly Met Ile Ile Leu Asn Glu Met 435 440 445

Gln Tyr Phe Tyr Glu Glu Gln Leu His Arg Met Glu Cys Met Ala Gln 450 455 460

Glu Pro Val Leu Phe Glu Asp Ile Val Cys Gln Met Thr Asp Met Ile 465 470 475 480

Gly Pro Ala Asn Glu Gly Arg Leu Thr Leu Arg Asp Leu Lys Arg Cys
485
490
495

Lys Leu Ser Gly Asn Phe Phe Asn Ile Leu Phe Asn Leu Asn Lys Phe 500 505 510

Val Ala Phe Glu Thr Arg Asp Pro Phe Leu Ile Arg Glu Arg Glu 515 520 525

Asp Pro Ser Leu Thr Glu Trp Asp Arg Phe Ala His Ile Glu Tyr Ile 530 535 540

Arg Leu Ser Met Glu Glu Asp Gly Glu Asp Ala Ser Asn Gly Ser Ala 545 550 555 560

Glu Val Trp Asp Glu Pro Gly Tyr Glu Ala Pro Phe 565 570

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Ala Thr Gly Ser Val Ala Ala Pro Leu Pro Ala Leu Glu Trp Lys Phe 20 25 30

Ser Gln Val Phe Gly Glu Arg Ala Ile Gly Glu Glu Val Gln Glu Val 35 40 45

Asp Ile Ile Ser Ala Ile Glu Phe Asp Lys Thr Gly Glu His Leu Ala 50 55 60

Thr Gly Asp Arg Gly Gly Arg Val Val Leu Phe Glu Arg Thr Asp Gly 65 70 75 80

Lys Asp Gln Arg Thr Arg Arg Glu Leu Glu Arg Ala Asp Ser Ala Gly 85 90 95

Ser Arg His Pro Glu Tyr Arg Tyr Ser Thr Glu Phe Gln Ser His Glu 100 105 110

Pro Glu Phe Asp Tyr Leu Lys Ser Leu Glu Ile Glu Glu Lys Ile Asn 115 120 125

Lys Ile Arg Trp Cys Gln Thr Ala Asn Ala Gln Phe Leu Ile Ser 130 135 140

Thr Asn Asp Lys Thr Ile Lys Leu Trp Lys Val Thr Glu Lys Lys Val 145 150 155 160

- Lys Gln Val Lys Asn Leu Asn Val Asp Pro Gly Ala Arg Gly Asn Gly 165 170 175
- Asn Pro Leu Ser Asn Asn Met Met Leu Asn Pro Lys Gly Phe Ala Pro 180 185 190
- Arg Leu Ser Met Asn Gly Val Ala Ala Asn Arg Ser Thr Pro Ala Ile 195 200 205
- Ser Pro Asp Phe Val Phe Pro Pro Gly Gly Ile Pro Ser Leu His Leu 210 215 220
- Pro Ser Val Trp Ser Asn Glu Thr Ala Leu Val Ala Arg Cys Arg Arg 225 230 235 240
- Ala Tyr Ala Asn Ala His Ala Tyr His Ile Asn Ser Ile Ser Asn Asn 245 250 255
- Ser Asp Cys Glu Thr Tyr Ile Ser Ala Asp Asp Leu Arg Ile Asn Leu 260 265 270
- Trp Asn Leu Glu Val Ser Asp Gln Ser Phe Asn Ile Val Asp Ile Lys 275 280 285
- Pro Thr Asn Met Glu Asp Leu Thr Glu Val Ile Thr Ser Ala Glu Phe 290 295 300
- His Pro Ser His Cys Asn Val Leu Ala Tyr Ser Ser Ser Lys Gly Ser 305 310 315 320
- Ile Arg Leu Ile Asp Met Arg Gln Ser Ala Leu Cys Asp Arg His Ser 325 330 335
- Lys Leu Phe Glu Glu Thr Glu His Ala Gly Ser Arg Ser Phe Phe Thr 340 345 350
- Glu Ile Ile Ala Ser Ile Ser Asp Ile Lys Phe Ala Arg Gly Gly Arg 355 360 365
- Tyr Ile Leu Ser Arg Asp Tyr Met Thr Leu Lys Leu Trp Asp Val Asn 370 380
- Met Glu Ser Ser Pro Val Ala Val Phe Lys Val His Glu Tyr Leu Arg 385 390 395 400
- Pro Lys Leu Cys Asp Leu Tyr Glu Asn Asp Ser Ile Phe Asp Lys Phe 405 410 415
- Glu Cys Cys Leu Ser Gly Asp Gly Met Arg Val Ala Thr Gly Ser Tyr 420 425 430
- Ser Asn Leu Phe Arg Val Phe Gly Ala Ala Thr Gly Ser Glu Glu Ala 435 440 445
- Ser Thr Leu Glu Ala Ser Lys Thr Pro Asn Arg Arg Ile Val Thr Pro 450 455 460

Pro Ser Lys Ala Gly Ser Arg Leu Ala Asn Leu Ala Arg Gly Arg Arg 465 470 475 480

Asp Asn Arg Arg Gly Glu Ser Pro Gly Ile Asp Leu Asn Gly Gly 485 490 495

Val Gln Asp Phe Thr Ser Lys Leu Leu His Leu Ala Trp His Pro Ala 500 505 510

Ala Asn Val Ile Ala Phe Ala Leu Ala Arg Cys Ser Leu His Pro Thr 515 520 525

Ala Cys Thr Cys 530

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1 5 10 15

Cys Lys Pro Leu Ser Glu Leu Glu Val Lys Asn Leu Cys Asp Gln Ala 20  $\phantom{-}25\phantom{+}30\phantom{+}$ 

Arg Thr Ile Leu Val Glu Glu Trp Asn Val Gln Pro Val Lys Cys Pro 35 40 45

Val Thr Val Cys Gly Asp Ile His Gly Gln Phe His Asp Leu Ile Glu 50 55 60

Leu Phe Arg Ile Gly Gly Lys Ala Pro Asp Thr Asn Tyr Leu Phe Met 65 70 75 80

Gly Asp Tyr Val Asp Arg Gly Tyr Tyr Ser Val Glu Thr Val Ser Leu 85 90 95

Leu Val Ala Leu Lys Val Arg Tyr Arg Asp Arg Ile Thr Ile Leu Arg
100 105 110

Gly Asn His Glu Ser Arg Gln Ile Thr Gln Val Tyr Gly Phe Tyr Asp 115 120 125

Glu Cys Leu Arg Lys Tyr Gly Asn Ala Asn Val Trp Lys Tyr Phe Thr 130 140

Asp Leu Phe Asp Tyr Leu Pro Leu Thr Ala Leu Ile Glu His Glu Ile 145 150 155 160

Phe Cys Leu His Gly Gly Leu Ser Pro Ser Leu Asp Thr Leu Asp His 165 170 175

Ile Arg Ala Leu Asp Arg Ile Gln Glu Val Pro His Glu Gly Pro Met 180 185 190 Cys Asp Leu Leu Trp Ser Asp Pro Asp Asp Arg Cys Gly Trp Gly Ile 195 200 205

Ser Pro Arg Gly Ala Gly Tyr Thr Phe Gly Gln Asp Ile Ala Glu Gln 210 215 220

Phe Asn His Thr Asn Gly Leu Ser Leu Val Ala Arg Ala His Gln Leu 225 230 235 240

Val Met Glu Gly Tyr Asn Trp Cys Gln Asp Lys Asn Val Val Thr Val 245 250 255

Phe Ser Ala Pro Asn Tyr Cys Tyr Arg Cys Gly Asn Met Ala Ala Ile 260 265 270

Met Glu Ile Asp Glu Thr Met Asn Arg Ser Phe Leu Gln Phe Glu Pro 275 280 285

Ala Pro Arg Gln Ser Glu Pro Asp Val Thr Arg Lys Thr Pro Asp Tyr 290 295 300

Phe Leu 305

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<212> PRT

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Met Gly Ile Tyr Leu Cys Ser Pro Lys Thr Asp Lys Thr Ser Glu Asp 1 5 10 15

Asp Glu Asn Ala Glu Leu Arg Tyr Gly Leu Ser Ala Met Gln Gly Trp 20 25 30

Arg Asp Ser Met Glu Asp Ala His Lys Ala Ile Leu Asn Val Asp Lys 35 40 45

Asn Thr Ser Thr Ser Ile Phe Gly Ile Phe Asp Gly His Gly Gly Lys
50 55 60

Leu Val Ala Lys Phe Cys Ala Lys His Leu His Gln Glu Val Leu Lys 65 70 75 80

Ser Glu Ala Tyr Ala Lys Gly Asp Leu Lys Ala Ser Leu Glu Tyr Ser 85 90 95

Phe Leu Arg Met Asp Glu Met Met Lys Gly Ala Ser Gly Trp Lys Glu 100 105 110

Leu Gln Ser Leu Glu Glu Thr Ser Ser Gln Leu Asp Lys Leu Gly Asn 115 120 125

Gly Asn Ser Ser Ser Asn Ala Arg Glu Asp Asp Glu Ser Asp Tyr Ser 130 135 140 Tyr Ala Val Leu Thr Glu Ser Asn Asp Ser Asn Leu Ala Thr Lys Lys 145 150 155 160

His Lys Tyr Ser Asp Phe Gln Gly Pro Ile Tyr Gly Ser Thr Ala Val 165 170 175

Val Ala Leu Ile Arg Gly Asn Lys Leu Phe Val Ala Asn Ala Gly Asp 180 185 190

Ser Arg Cys Ile Met Ser Arg Gly Glu Ala Val Asn Leu Ser Ile 195 200 205

Asp His Lys Pro Asn Leu Glu His Glu Arg Lys Arg Ile Glu Ser Ala 210 215 220

Gly Gly Phe Val His Gly Gly Arg Val Asn Gly Ser Leu Asn Leu Thr 225 230 235 240

Arg Ala Ile Gly Asp Met Glu Phe Lys Gly Arg Pro Asp Leu Pro Pro 245 250 255

Asp Lys Gln Val Val Thr Cys Cys Pro Asp Val Val Glu Val Asp Leu 260 265 270

Gly Pro Gly Asp Glu Phe Ile Val Leu Ala Cys Asp Gly Ile Trp Asp 275 280 285

Val Met Ser Ser Gln Ala Val Val Asp Phe Val Lys Ser Arg Leu Pro 290 295 300

Thr Thr Lys Thr Leu Ser Ser Leu Cys Glu Glu Ile Leu Asp Tyr Cys 305 310 315 320

Leu Ser Pro Thr Thr Arg Gln Gln Glu Gly Cys Asp Asn Met Ser Ile 325 330 335

Ile Ile Val Gln Pro Lys Gln Ser Gly Val Ala Ala Ser Ser Ser Thr 340 345 350

Asp

<210> 15

<211> 371

<212> PRT

<213> Physcomitrella patens

<400> 15

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Gln Lys Tyr Thr His Leu Gly Glu Glu Asn Gly Asp Asn His Asp Pro 20 25 30

Leu Leu Trp His Lys Asp Leu Gly Asp His Ala Ala Gly Gln Phe Ser 35 40 45

- Ile Ala Ala Val Gln Ala Asn Ala Ile Leu Glu Asp Met Val Gln Val
  50 60
- Glu Thr Gly Pro Phe Gly Thr Phe Val Gly Val Tyr Asp Gly His Gly 65 70 75 80
- Gly Pro Glu Ala Ser Arg Tyr Val Asn Asp Ser Leu Tyr Arg His Leu 85 90 95
- Gln Lys Phe Ala Thr Gln His Gly Gly Met Ser Ser Glu Val Leu Gln
  100 105 110
- Gln Ala Phe Lys Gln Thr Glu Glu Gly Phe Leu Glu Ile Val Arg Asp 115 120 125
- Ser Trp Leu Thr Lys Pro Gln Ile Ala Ala Val Gly Ser Cys Cys Leu 130 135 140
- Val Gly Val Val Trp Glu Cys Lys Leu Tyr Ile Ala Ser Leu Gly Asp 145 150 155 160
- Ser Lys Ala Val Leu Gly Arg Phe Ser Arg Asn Leu Gln Ser Val Ile 165 170 175
- Ala Thr Glu Ile Ser Thr Glu His Asn Ala Ser Val Glu Ala Val Arg 180 185 190
- Gln Asp Leu Gln Ala Ala His Pro Asp Asp Pro Arg Ile Val Val Leu 195 200 205
- Arg His Gly Val Trp Arg Val Lys Gly Leu Ile Gln Val Ser Arg Ser 210 215 220
- Ile Gly Asp Val Tyr Leu Lys Lys Ala Glu Phe Asn Arg Glu Pro Leu 225 230 235 240
- Ile Gly Arg Phe Arg Leu Pro Glu Pro Leu Gln Arg Pro Val Met Ser 245 250 255
- Ala Glu Pro Asp Ile Arg Val Ile Asp Leu Thr Pro Asp Val Glu Phe 260 265 270
- Val Ile Phe Ala Ser Asp Gly Leu Trp Glu His Leu Ser Asn Gln Glu 275 280 285
- Ala Val Asp Ile Val His Lys Tyr Pro Arg Ala Gly Ile Ala Arg Gln 290 295 300
- Leu Ile Arg Tyr Ala Leu His Glu Ala Ala Lys Lys Arg Glu Met Arg 305 310 315 320
- Tyr Ser Asp Leu Lys Lys Ile Glu Arg Gly Ile Arg Arg His Phe His 325 330 335
- Asp Asp Ile Thr Val Val Val Val Phe Leu Asp His Asn Leu Val Ser 340 345 350

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Asn Gly Ser Gly Ile Ser His His Ile Ser Val Lys Gly Val Asp
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Lys Pro Ser
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ctaaagggaa caaaagctg
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<210> 18
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<400> 18
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tgtaaaacga cggccagt
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<211> 26
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ctgccgttgg aggcatcctc gccatc
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